

Helium-Neon Laser Manual



Research Electro-Optics, Inc.

**VISIBLE WAVELENGTH
HELIUM-NEON LASER SYSTEM
USER'S GUIDE TO OPERATION**

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PREFACE

This User's Guide is designed to assist you in the daily operation and maintenance of your new Helium-Neon (He-Ne) laser system. The information contained within this User's Guide should answer most of your questions concerning the use and operation of this laser system.

This guide contains six sections:

- Section I: Provides information on unpacking your laser system.
- Section II: Provides important safety information for operating your laser system.
- Section III: Provides instructions on connecting your laser to the power supply, proper operating procedures, and some general information about your laser system.
- Section IV: Describes procedures for basic troubleshooting of your laser system.
- Section V: Gives information concerning the warranty of your laser system. It also provides instructions for returning the laser for service.
- Section VI: Provides the specifications for your laser system.

SECTION I UNPACKING

This section describes:

- how to unpack and inspect your laser system
- what is included in your shipment

NOTE: PLEASE KEEP ALL PACKING MATERIALS FROM YOUR SHIPMENT IN CASE YOU NEED TO RETURN ANYTHING!!

UNPACKING

- 1) Carefully remove the laser head (or tube) from the shipping container.
- 2) Inspect the laser head (or tube) for any obvious damage as follows:
HEAD:
 - Check for broken legs at the end of the laser power cord.
 - Gently turn laser head upside down, listen for any noise.**TUBE:**
 - Check for broken or cracked glass.
 - If included, check the power cable for any damage.
- 3) Remove the power supply from the shipping container (if included).
- 4) Inspect the power supply for damage as follows:
PACKAGED POWER SUPPLY:
 - Ensure there is one key included and that it is not bent.
 - Check the housing for any damage.
 - Check the power cord for any damage.**OEM POWER SUPPLY:**
 - Check the module for any obvious damage.
 - Check that none of the wires or connectors are damaged or broken.
 - Ensure that a wiring diagram for your particular power supply model is included in Section VI.
- 5) If anything listed above is missing or damaged, please notify REO immediately! See Section V for information on returning the laser for repair.

NOTE: PLEASE KEEP ALL PACKING MATERIALS FROM YOUR SHIPMENT IN CASE YOU NEED TO RETURN ANYTHING!!

SHIPPING INVENTORY

The equipment included in this shipment should match the packing slip attached to the box. Matching the serial number(s) is an accurate way to check. If the shipment is incomplete or if an incorrect item was shipped to you, please notify REO immediately. See Section V for further information on returning the unit.

SECTION II LASER SAFETY

The laser described in this User's Guide has visible light power. It is safe to operate provided that the user pays attention to all safety warnings. It is recommended that all personnel who will operate or be in the vicinity of the laser during operation read and be familiar with this manual as well as be made aware of the following safety warnings.

- 1) Never look directly into the laser light source or at scattering laser light from any reflective surface. Laser light is hazardous to the eyes. Never sight down the beam into the source.
- 2) Maintain experimental set-ups at low heights to prevent inadvertent beam-eye contact.
- 3) Whenever the laser is running and the beam is not in use, block the beam with either the shutter on the output aperture or with a non-reflective material (piece of dark colored paper, cardboard, etc.). Avoid direct exposure to the laser beam.
- 4) Ensure that the laser head is securely connected to the power supply. Failure to do so may result in shock.
- 5) High voltage is present at all times. Provide adequate insulation at the high voltage connections of an OEM laser tube.
- 6) Do not attempt to open the sealed laser housing. This will expose personnel to high voltage and dangerous radiation. It will also void your warranty.
- 7) Post warning signs in the area of the laser to alert other people.
- 8) Keep all unnecessary personnel out of the area where the laser is being used.
- 9) As a precaution against accidental exposure to either the laser beam or its reflection, operators should wear laser safety glasses designed for this type of laser.*

CAUTION: USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE. IT WILL ALSO VOID YOUR WARRANTY.

* Laser safety glasses are available from many companies, such as Newport 1-800-222-6440 or www.newport.com.

CDRH REGULATIONS

All laser products manufactured on or after August 2, 1976 for sale in the United States must conform to the performance and safety regulations 21 CFR Subchapter J 1040.10 and 1040.11. This federal regulation is administered by the National Center for Devices and Radiological Health (CDRH, formerly known as BRH, the Bureau of Radiological Health) under the Food and Drug Administration. All end users (including OEM) must always purchase CDRH compliant laser systems, except for replacement parts for products manufactured prior to August 2, 1976. It is the responsibility of the manufacturer of the final product or system to ensure that the CDRH requirements are met by that product or system.

Each REO Helium-Neon laser system, which is certified to be in compliance with the CDRH regulations, is equipped with a key-switch, remote interlock connector, laser radiation emission indicator (on the front of the power supply), time delay relay (built into the power supply), a beam attenuator (or shutter, located in the front bezel of the laser housing), and all appropriate warning labels. OEM power supplies come equipped with a built-in time delay relay. Again, it is the responsibility of the manufacturer of the final product or system to ensure that the CDRH requirements are met by that product or system.

For further information and assistance on laser safety, contact the following agencies:

Laser Institute of America
13501 Ingenuity Drive, Suite 128
Orlando, Florida 32826
** Safety Guides **

American National Standards Institute, Inc.
25 West 43rd Street
New York, NY 10036
** Safety Guides **

Food & Drug Administration
Center For Devices & Radiological Health
2098 Gaiter Road
Rockville, MD 20850

CE COMPLIANCE

For European customers who require a CE approved laser system, REO certifies that our laser heads and lab power supplies meet the appropriate CE requirements. In order for the CE regulations to be met, all REO lab power supplies must be used with an input line cord with a length of 3 meters or less. The factory included line cord has a length of approximately 2 meters. Other cords may be used, but they must have a length of no longer than 3 meters in order for the laser system to remain CE compliant.

SECTION III INFORMATION, ASSEMBLY, and OPERATION

This section:

- provides some general information on your laser system
- describes how to assemble your laser system
- describes how to operate your laser system

GENERAL INFORMATION

LASER HEADS

All laser heads are equipped with a beam attenuator (or shutter) installed in the front bezel of the laser housing, and a six-foot long high voltage coaxial cable terminated with an Alden 8102M male high voltage connector. This allows for connection to most standard power supplies. REO laser heads are designed to operate at an optimum performance level when used with an REO power supply. They will also operate with a customer furnished power supply that is capable of providing the start voltage, operating current, and operating voltage requirements listed in the specifications in Section VI. Please contact REO if you have any questions concerning power supply compatibility.

The cylindrical construction of the laser head allows for easy mounting in ring clamps, V-blocks, or similar mounting hardware without affecting the laser's alignment. When mounting the laser head, we recommend using a cushion material, such as foam or rubber, in-between the mounting and the laser head. This will prevent the laser housing from becoming damaged. The front bezel has four each 4-40 Unified National Coarse Thread (UNC) holes to secure the optional accessory mounting ring. The ring (part number 30646), which is available for purchase from REO, incorporates 1" diameter, 32 threads-per-inch (TPI) female threads.

REO lasers are also available as OEM products. They are usually sent as a bare tube, with several options for electrical connections. We offer an attached ground wire, an Alden 8102M male high voltage connector with a 12" cord and an in-line resistor, the previously mentioned cord terminated with alligator clips, or a separate resistor assembly that you install yourself. You may also combine the ground wire with any of the above high voltage connections.

There are no adjustment mechanisms on an REO laser head. However, some wavelengths, primarily the 543 nm (Green), can be rotationally sensitive. You may wish to slowly rotate the laser head (or tube) to find its peak power position. Additionally, magnets may be provided with the linearly polarized 543 nm lasers. Their purpose is two-fold: to increase the power by coupling all excited state levels to the lasing mode, and to suppress the 3392 nm infra-red line.

LASER POWER SUPPLIES

Three options are available when purchasing a power supply from REO. The packaged power supply is available in two forms, a Laboratory Power Supply (hence the LPS), and a CE certified Laboratory Power Supply (hence the CPS). Both are enclosed in a protective housing and are equipped with a built-in 3-5 second time delay, an Alden 8102F female high voltage connector, a key lock switch with two removable keys, a laser radiation emission indicator, an input voltage selection switch, and a remote interlock connector. The OEM power supply comes as a bare "brick" with an Alden 8102F female high voltage connector attached to allow for use with the REO laser head. Power supplies are available for use with both 115 VAC and 230 VAC inputs. Other voltages are also available upon request.

ASSEMBLY OF THE LASER SYSTEM

PACKAGED POWER SUPPLY

- 1) Plug the laser power cord into the rear of the power supply.
- 2) With the key switch in the front of the power supply turned off, plug the power supply into a power source that will supply the specified input voltage for your system.

NOTE: The input power cord is a 3-wire cable. Make sure to use a suitable grounded power outlet.

OEM POWER SUPPLY

NOTE: DO NOT APPLY POWER TO THE POWER SUPPLY UNTIL IT IS CONNECTED TO THE LASER.

- 1) If your power supply is equipped with an Alden 8102F female connector, plug the laser power cord into this connector.
- 2) If your power supply is equipped with "flying leads", ensure your laser is properly connected as follows:
 - A) Connect the red high voltage wire to the anode pin (the metal pin that sticks out of the neck of the laser).
 - B) Connect the black ground wire to the ground strap (if included) or to the metal body of the tube.
- 3) If your power supply does not have a line cord for the input power, connect it to the power source according to the wiring diagram in Section VI. If you have any questions, please call REO for assistance.

OPERATION

- 1) When the laser and power supply have been properly connected (following the above steps), open the shutter located at the front of the laser housing. The shutter is open when the slot is lined up parallel with the housing.
- 2) Apply power to the laser by "turning on" the power supply. This is done in one of two ways; either by turning the key switch to the "ON" position or by applying power to the power supply. On the packaged power supply, the emission indicator will illuminate immediately, indicating that power has been applied to the laser and that laser emission can be expected in approximately 3-5 seconds. If the laser fails to operate, please refer to Section III for some basic troubleshooting steps.

CAUTION: THE USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE (FDA CAUTION STATEMENT 21 CFR 1040.10(h)(1)(IV)). IT WILL ALSO VOID YOUR WARRANTY.

UNAUTHORIZED MODIFICATIONS TO THE LASER OR POWER SUPPLY MAY CAUSE IRREVERSIBLE DAMAGE TO THE SYSTEM, AS WELL AS RESULT IN POSSIBLE HAZARDOUS RADIATION EXPOSURE. THESE MODIFICATIONS WILL ALSO VOID ALL WARRANTIES. REPAIRS TO SUCH MODIFIED EQUIPMENT WILL BE CHARGED AT THE CURRENT REPAIR RATE, PLUS THE COST OF ANY REQUIRED PARTS.

SECTION IV BASIC TROUBLESHOOTING

The He-Ne laser is very simple to operate and maintain. Once power is applied to the laser, it should emit a beam of light within 3-5 seconds. If it doesn't, here are a few quick checks you can perform to troubleshoot your laser system.

NOTE: DO NOT LOOK DIRECTLY INTO THE LASER, EVEN IF NO VISIBLE LIGHT IS BEING EMITTED.

LABORATORY POWER SUPPLY

- 1) Is it plugged into and receiving the correct input voltage? Check this by looking at the front panel of the power supply. There is a red switch on the left hand side. Ensure that it reads the same as your input source.
- 2) Is the remote connector plug, located on the rear panel of the lab power supply, installed? (Or is that circuit complete?)
- 3) Does the green emissions indicator light, located in the upper left hand corner on the front panel, illuminate when the power supply is turned on?

OEM POWER SUPPLY

- 1) Is the power supply correctly wired into your power source? Verify this by comparing your wiring to the wiring diagram shown on the enclosed power supply specification sheet in Section VI.
- 2) Verify that your power source is properly functioning.

LASER

- 1) Is it plugged securely into the power supply?
- 2) Is the shutter open? (See Section II, Step 1 for instructions.)

If the above checks are all answered 'yes' and the laser is still not operating properly, the unit(s) will need to be returned to REO for evaluation and repair/replacement. Please see Section V for information on returning the unit(s).

SECTION V WARRANTY INFORMATION

WARRANTY POLICY

REO lasers and power supplies are warranted to be free from defects in materials and workmanship for a period of 12 months from the date of the initial shipment. This warranty does not extend to damage caused by negligent or improper handling in use, storage, or transportation, nor for products from which the original identification markings or labels have been removed, defaced, or altered.

Special contracts or contracts for non-standard products may have modified terms of warranty and, in such cases, the terms as stated in the individual contract must be signed by the duly authorized officer of REO and will supersede the standard terms. REO reserves the right to change our warranty policy without any prior notice. Please contact REO directly with any questions pertaining to your warranty.

REO will make the final determination as to the cause or existence of the defect and, at our discretion, repair or replace the products that prove to be defective during the warranty period. Products replaced under warranty will be warranted only for the balance of the warranty period of the originally supplied equipment. Additionally, any purchased replacement parts, i.e. laser tubes, power supply modules, etc., are warranted for a six-month (6) period.

This warranty extends only to the original purchaser of the equipment from REO, and is not transferable. The purchaser must notify REO within 15 days of first noticing the defect and promptly return the defective product before the expiration of the warranty period. Products returned from persons not employed by the original purchaser will not be evaluated without prior consent from the original buyer.

Products believed by the purchaser to be defective shall be returned to REO. Transportation, insurance, duties, etc., are to be paid by the purchaser. Repaired or replaced products will be returned to the purchaser by REO, F.O.B. city of destination, domestic as well as foreign territories. REO will not be responsible for any duties, levies, taxes, etc., on returned items.

WARRANTY PROCEDURE

Review the terms of your purchase and the date of shipment to determine the validity of your warranty claim. Warranty claims should only be made for products that are within the terms of the warranty policy. However, out-of-warranty items may be returned for evaluation at no charge.

Prior to returning any unit for repair or evaluation, please contact REO either by phone at (303) 938-1960 or by fax at (303) 447-3279 to obtain authorization to return the unit in the form of a Return Authorization number. This number is valid for a set period of time; 30 days for domestic customers, 45 days for foreign customers. If the unit is not received within this time frame, the authorization number will be closed out and you will need to call to obtain a new authorization number. For returns in foreign countries where representation is present, please contact your distributor. For customers in the U.S.A. and countries where distributorships and/or representation is not available, all claims and correspondence should be addressed to:

Research Electro-Optics
Attn: Laser Service Department
5505 Airport Boulevard
Boulder, Colorado 80301
Ref: Return Authorization Number

Please be prepared to furnish the following information when requesting an authorization number:

- a. Product model number and serial number
- b. Date of shipment/purchase
- c. Brief description of problem/failure
- d. Name and phone number of contact person at your organization.

Obtain REO instructions for transportation and packaging, and ship the product (freight and insurance prepaid) with the proper documentation containing the authorization number and the information specified above. Please ensure the authorization number is visible on the front of the shipping container.

REO will advise the purchaser of its evaluation results at the earliest possible time. Providing complete information as requested will help to expedite this process. For products outside of their warranty period, an evaluation will be made at no charge and a cost estimate for repair/replacement will be issued. Only after receiving authorization (in the form of a Purchase Order) will any repair/replacement work be performed. Charges for repair work will be billed at the current repair rate (available upon request from REO) plus the cost of any additional required parts. Repair work will be warranted for a period of 6 months from the date of shipment.

**SECTION VI
LASER SPECIFICATIONS**

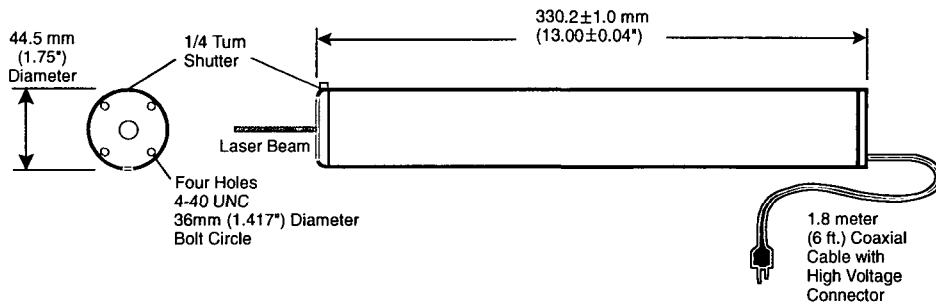
The following page(s) contain detailed information concerning your specific laser system. Please feel free to contact the laser department at REO if you have any questions concerning your laser system. REO can be reached at (303) 938-1960 or by fax at (303) 447-3279.

TECHNICAL DATA
LHRP-0201
30989
CYLINDRICAL HELIUM-NEON LASER HEAD

Wavelength	633 nm
Minimum Output Power	2.0 mW
Power 3 Seconds After Turn-On	> 75%
Polarization	Linear > 500:1
Mode Structure	TEM ₀₀ > 99%
Beam Diameter	0.81 mm
Beam Divergence	1.00mrad
Longitudinal Mode Spacing	566 MHz
Beam Drift After 20 Minute Warm-Up	< 0.2 mrad
Long Term Beam Drift	< 0.05 mrad
Noise (30 Hz - 10 MHz)	< 1% rms
Starting Voltage	< 10 kVDC
Operating Voltage	1800 VDC
Series Resistors in Housing	94 KΩ
Operating Current	5.25 mA
Shock	15 g for 11 msec
Weight	600 grams
Dimensions	
Length	330.2±1.0 mm (13.00±0.04")
Diameter	44.5±0.5 mm (1.75±0.02")
Maximum Output Power	5.0 mW
CDRH Classification	IIIa
Recommended Power Supply	LPS or CPS

ENVIRONMENTAL SPECIFICATIONS

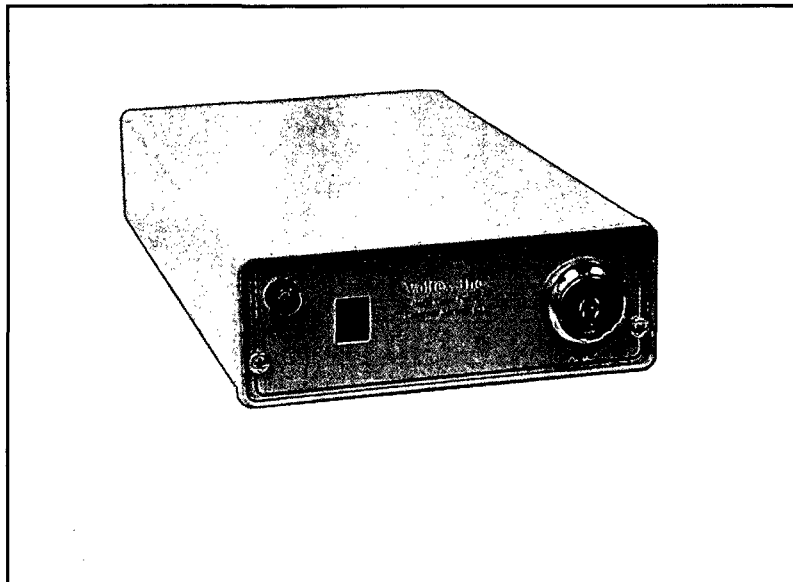
	<u>Operating</u>	<u>Non-Operating</u>
Temperature	-20 - +70° C	-40 - +80° C
Humidity	≤ 80%	≤ 95%
Altitude	0-3,000 meters	0-6,000 meters



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Voltex HeNe Laser Power Supply

Model S-22-LI



The Voltex S series of dual AC input laboratory power supplies represents the state of the art in compact, ultra-high reliability switching power supplies. Designed to provide very high conversion efficiency, the power supply module is fully encapsulated in a specially formulated epoxy for maximum heat dissipation and electrical insulation. This module is packaged in an attractive vinyl covered aluminum and steel enclosure for maximum durability and EMI/RFI suppression. This power supply:

- Operates most 2 mW through 7 mW HeNe lasers.
- 115 VAC or 230 VAC input is switch selectable on front panel.
- Delivers > 85% conversion efficiency for cool operation and long life.
- Has an internal bleed-down resistor to reduce shock hazard.
- Internal module has TÜV approval to IEC 950, EN 60950, and VDE 0805.
- Keyed power switch and safety interlock plug included.
- Has a full 18-month warranty.

For further information, pricing and delivery, please contact:

Voltex, Inc.
1009 Elkton Drive
Colorado Springs, CO
80907

Tel: (719) 599-0531
Fax: (719) 599-7851
Website: www.voltex.net

S-22-LI SPECIFICATIONS

Input:

Input Volts:	115 or 230 VAC +/-10%. 50-400 Hz
Input Current:	.4 / .2 A Max.*
Line filtering:	EMI line filter included.
Remote plug:	2-prong removable plug on rear panel allows remote disconnect of AC power (Jumpered plug included).

Output:

Voltage:	1900-2600 VDC
Current:	4 to 7 mA. User adjustable
Start Voltage:	>10 KV
Output Current Ripple:	< 5% P – P (< 2% RMS) **
Output Fault Protection:	Open, Short, Arc
Conversion Efficiency:	> 85%
CDRH Delay:	3 – 5 seconds. (Cut violet loop to disable)
Output Connector:	Alden style, high voltage

Dimensions:

HxWxD:	1.5" x 4.125" x 7.875" (38 X 150 X 200mm)
Enclosure:	Aluminum base, front and rear panels. Vinyl covered steel top in black (standard) or gray.

* Input Current varies with line and load.

** Measured current ripple will vary with type of laser and current setting.

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1009 Elkton Drive
Colorado Springs, CO
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Tel: (719) 599-0531
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Website: www.voltex.net



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